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BEFORE THE BOARD OF PATENT APPEALS AND INTERFERENCES

Paper No. 040309

Application Number: 09/851,839
Filing Date: May 09, 2001
Appellant(s): SHI, BINQIANG

Richard Berg
For Appellant

EXAMINER'S ANSWER

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This is in response to the appeal brief filed 12/29/2003.

(1) Real Party in Interest

A statement identifying the real party in interest is contained in the brief.

(2) Related Appeals and Interferences

The brief does not contain a statement identifying the related appeals and interferences which will directly affect or be directly affected by or have a bearing on the decision in the pending appeal is contained in the brief. Therefore, it is presumed that there are none. The Board, however, may exercise its discretion to require an explicit statement as to the existence of any related appeals and interferences.

(3) Status of Claims

The statement of the status of the claims contained in the brief is correct.

(4) Status of Amendments After Final

The appellant's statement of the status of amendments after final rejection contained in the brief is correct.

(5) Summary of Invention

The summary of invention contained in the brief is correct.

(6) Issues

The appellant's statement of the issues in the brief is correct.

(7) Grouping of Claims

Appellant's brief includes a statement that claims 1-27, 29-33 and 39-40 do not stand or fall together and provides reasons as set forth in 37 CFR 1.192(c)(7) and (c)(8).

(8) Claims Appealed

The copy of the appealed claims contained in the Appendix to the brief is correct.

(9) Prior Art of Record

4,876,218	Pessa et al.	10-1989
4,824,518	Hayakawa et al	4-1989
4,897,367	Ogasawara	1-1990
5,094,974	Grunthaner et al	3-1992
4,330,360	Kubiak et al	5-1982

(10) Grounds of Rejection

The following ground(s) of rejection are applicable to the appealed claims:

Claims 1-11, 25-27, 29-31 and 39-40 are rejected under 35 U.S.C. 103(a) as being unpatentable over Pessa et al (US 4,876,218) in view of Hayakawa et al (US 4,824,518).

Pessa et al discloses a method of a GaAs film on the surface of a Si or GaAs substrate (abstract), where an effusion cell **3** contains a Ga elementary component of a GaAs compound, e.g. Ga atoms, and an effusion cell **4** contains the As elementary component, e.g. as As_4 molecules. Pessa et al also teaches heating the substrate to a first growing temperature of 100°C to 500°C, heating the Ga effusion cell **3** to 800°C and heating the As effusion cell **4** to 300°C. Pessa et al also teaches opening a shutter **6** in front of As cell and a vapor beam of As_4 molecules is allowed to act on the surface of the substrate for a period of time which is required for the formation of one atom layer, this reads on applicant's first layer of material over the substrate, and excess arsenic is removed through re-evaporation and the growing surface by one atom layer only. Pessa et al also teaches shutter **6** is closed and a shutter **5** is opened and a vapor beam containing Ga atoms is allowed to act on the growing surface until a number of Ga atoms corresponding to a single atom layer reaches the growing surface, this reads on applicant's

second layer of second material over the first layer (col 3, ln 1-60). The As layer and the Ga layer of atoms forms a buffer layer, where the buffer layer cause reduction in lattice strain by creating mismatch dislocations which have a relatively low of action and which as a result lead to the reduction of treading dislocations (col 2, ln 25-43 and col 3, ln 61-64), this reads on applicant's first layer substantially accommodates strain accumulated between the first crystal and the second crystal during epitaxial growth, thereby preventing strain relaxation and formation of dislocation defects. Pessa et al also teaches after the growth of the buffer layer, the substrate is heated to a second growth temperature ranging from 500-700°C and both the Ga and As beams act simultaneously on the growing surface until the desired GaAs film thickness is obtained by Molecular Beam Epitaxy (col 3, ln 65 to col 4, ln 10), this GaAs layer reads on applicant's second crystal. Also the substrate of Si or GaAs inherently has a lattice constant and the GaAs epitaxial film inherently has a lattice constant.

Pessa et al does not teach cleansing a surface of the first crystal by thermal desorption.

In a method of production semiconductor devices, Hayakawa et al teaches a GaAs substrate is heated to about 600°C during a radiation treatment by an As_4 molecular beam with about 10^{-6} to 10^{-5} torr and is allowed to stand at about 600°C for about 10 minutes, and after which the temperature of the GaAs substrate is lowered to 200°C or less during a radiation treatment by the As_4 molecular, thereby achieving complete removal of an oxidized film formed on the GaAs substrate and obtaining a GaAs substrate with a clean surface (col 4, ln 5-67), this reads on applicant's cleansing by thermal desorption. Hayakawa et al also teaches removing oxidized film of GaAs with an As molecular beam with a high pressure of 10^{-4} to 10^{-5} torr (col 1, ln 55-67). Hayakawa et al also teaches growing high quality GaAlInP epitaxial layers by MBE

on a GaAs substrate (col 5, ln 1-30). It would have been obvious to a person of ordinary skill in the art at the time of the invention to modify Pessa et al with Hayakawa et al to clean the surface of the substrate to remove oxide from the surface, which is detrimental to epitaxial growth.

Referring to claims 2-3, the combination of Pessa et al and Hayakawa et al teaches heating to 600°C and an As pressure of 10^{-5} to 10^{-4} torr (.013 to 0.0013 Pa). Overlapping ranges are held to be obvious (MPEP 2144.05)

Referring to claim 6, the combination of Pessa et al and Hayakawa et al teaches removing excess arsenic by re-evaporation, so the growing surface grows by only one atom layer at a time (col 3, ln 45-47), this reads on adjusting the thickness by varying a temperature of the first crystal. The combination of Pessa et al and Hayakawa et al is silent to the first vapor condenses on the surface of the first crystal. This is inherent to the combination of Pessa and Hayakawa et al because a layer of Arsenic is formed on a substrate held at a low temperature, 100°C, from arsenic vapor. The As vapor is at a temperature of 300°C and the substrate is at a temperature is a temperature of 100°C, hot vapors inherently condense on cool . This is a well-known concept in the art.

Claims 12-16 and 18-22 are rejected under 35 U.S.C. 103(a) as being unpatentable over Pessa et al (US 4,876,218) in view of Hayakawa et al (US 4,824,518) as applied to claims 1-11 above, and further in view of Ogasawara (US 4,897,367).

The combination of Pessa et al and Hayakawa et al teaches all of the limitations of claim 12 including depositing a Ga layer on a As layer at a substrate temperature of 100-500°C and heating the substrate to a second growth temperature ranging from 500°C-700°C, this reads on

annealing, as discussed previously in claim 6. The combination of Pessa et al and Hayakawa et al does not teach annealing the second layer by raising the temperature of the first crystal under a pressure of the first vapor of about 0.008 Pa.

In a method of growing GaAs, note entire reference, Ogasawara teaches depositing a GaAs layer **2** on a silicon substrate **1**, where the GaAs layer is formed at a substrate temperature of 60°-90°C by irradiating an As beam and a Ga beam on the substrate. Ogasawara also teaches the temperature of the substrate **1** is increased to 200°C-400°C, while irradiating the substrate with an As beam to prevent out-diffusion of As from the GaAs layer **2** when heated (col 2, ln 10-67). Ogasawara also teaches a Ga beam is irradiated in an amount needed to form a GaAs monomolecular layer (for about 1 sec). It would have been obvious to a person of ordinary skill in the art at the time of the invention to modify the combination of Pessa et al and Hayakawa et al with Ogasawara by irradiating a GaAs layer with an As beam to prevent out-diffusion of As during a heating step.

Referring to claim 16, the combination of Pessa et al, Hayakawa et al and Ogasawara teaches a first crystal of GaAs and a first material of As_4 and a second material of Ga. The combination of teaches the vapor has a temperature of 800°C. The combination of Pessa et al, Hayakawa et al and Ogasawara is silent to the pressure of the second vapor. The sole difference between the prior art and the claimed limitations is the pressure and temperature of the vapor. The selection of reaction parameters such as temperature and concentration is obvious (In re Aller 105 USPQ 233, 255 (CCPA 1955)). Pressure is well known in the art to be a result effective variable.

Referring to claim 19, the combination of Pessa et al, Hayakawa et al and Ogasawara teaches opening the shutter for 1 second and is silent to the number per surface area of group III atoms form the monolayer is about 6.5e14 cm^{-2}. The selection of reaction parameters such as temperature and concentration is obvious (In re Aller 105 USPQ 233, 255 (CCPA 1955)). The Flux of a reactant is well known in the art to be a result effective variable. Also the prior art show the amount of time the shutter is open results in more atoms reaching the surface.

Claims 17 and 23-24 are rejected under 35 U.S.C. 103(a) as being unpatentable over Pessa et al (US 4,876,218) in view of Hayakawa et al (US 4,824,518) and Ogasawara (US 4,897,367) as applied to claims 12-16 and 21-22 above, and further in view of Grunthaner et al (US 5,094,974).

The combination of Pessa et al, Hayakawa et al and Ogasawara teaches all of the limitations of claim 23, as discussed previously in claim 22, except the ratio of the group V flux to the group III flux is substantially in the range of about 1.5 to about 3.

In a method of growing group III-V films by control of MBE growth stoichiometry, Grunthaner et al teaches instantaneous flux ratios of In to As have been critical to the control of defect generation in the lattice mismatched epitaxy of InAs on GaAs (col 2, ln 25-40). Grunthaner et al also teaches a substrate temperature of 250-750°C during deposition of an InAs on a GaAs layer (col 4, ln 1-10). It would have been obvious to a person of ordinary skill in the art at the time of the invention to modify the combination of Pessa et al, Hayakawa et al and Ogasawara with Grunthaner by optimizing the ratio of group V flux to the group-III flux substantially in the range of 1.5 to about 3 by conducting routine experimentation. The selection

of reaction parameters such as temperature and concentration is obvious (In re Aller 105 USPQ 233, 255 (CCPA 1955)). The ratio of fluxes is a result effective variable as taught by Grunthaner et al.

Referring to claim 17, the combination of Pessa et al, Hayakawa et al and Ogasawara is silent to the combination of Ga,Al and In are in relative ratio substantially equal to the ratio of elements forming the second crystal. The selection of reaction parameters such as temperature and concentration is obvious (In re Aller 105 USPQ 233, 255 (CCPA 1955)). The ratio of fluxes is a result effective variable as taught by Grunthaner et al.

Referring to claim 24, the combination of Pessa et al, Hayakawa et al and Ogasawara does not teach a second crystal of InAs, $In_xGa_{1-x}As$, $In_xAl_{1-x}As$ or GaP. It would have been obvious to a person of ordinary skill in the art at the time of the invention to modify the combination of Pessa et al, Hayakawa et al and Ogasawara with Grunthaner to form an InAs layer, which is useful in Josephson devices ('974 col 5, ln 1-7).

Claims 32-33 are rejected under 35 U.S.C. 103(a) as being unpatentable over Pessa et al (US 4,876,218) in view of Hayakawa et al (US 4,824,518) and Ogasawara (US 4,897,367) and Grunthaner et al (US 5,094,974) as applied to claims 17 and 23 above, and further in view of Kubiak et al (US 4,330,360).

The combination of Pessa et al, Hayakawa et al, Ogasawara and Grunthaner et al teaches all of the limitations of claim 32, as discussed previously, including heating a substrate to 600°C and annealing under a pressure of As_4 vapor, which is equivalent to As_2, of 10^{-4} to 10^{-5} Torr (.013 to .0013 Pa). ('518 col 4, ln 45-55 and col 1, ln 45-67). The combination of Pessa et al,

Hayakawa et al, Ogasawara and Grunthaner et al also teaches growing one arsenic atom layer and removing excess arsenic through re-evaporation, where the evaporation temperature of As in on the order of 300°C. The combination of Pessa et al, Hayakawa et al, Ogasawara and Grunthaner et al also teaches it is impossible to lower the strength of the As molecular beam which has an extremely high pressure of 10^{-4} to 10^{-5} in a short time, therefore As used in the growth chamber is present during growth of compound semiconductors ('518 col 1, ln 45 to col 2, ln 5), this reads on applicant's subjecting the substrate to an As_2 vapor pressure of about 0.008 Pa for forming a monolayer of In atoms. The combination of Pessa et al, Hayakawa et al, Ogasawara and Grunthaner et al also teaches annealing under an As_4 pressure and the buffer layer reduces dislocations between the substrate and the epitaxial layer, this reads on applicant's epitaxial growth does not introduce dislocation defects cause by lattice mismatch. The combination of Pessa et al, Hayakawa et al, Ogasawara and Grunthaner et al is silent to introducing In vapor at a temperature of about 790°C.

In an MBE process using group V elements, Kubiak et al teaches nominal effusion cell temperatures range from 900-1000°C for Ga and 800-840°C for In depending on the effusion cell to substrate distance and the group III beam intensities may be regulated by varying the effusion cell temperature (col 3, ln 40 to col 4, ln 15). It would have been obvious to a person of ordinary skill in the art at the time of the invention modify the combination of Pessa et al, Hayakawa et al, Ogasawara and Grunthaner et al with Kubiak et al by optimizing the effusion cell temperature by conducting routine experimentation of result effective variables. The selection of reaction parameters such as temperature and concentration is obvious (In re Aller 105 USPQ 233, 255 (CCPA 1955)).

Referring to claim 33, the combination of Pessa et al, Hayakawa et al, Ogasawara and Grunthaner et al and Kubiak et al does not teach a ratio of flux is maintained at 2.5. The selection of reaction parameters such as temperature and concentration is obvious (In re Aller 105 USPQ 233, 255 (CCPA 1955)).

(11) Response to Argument

The combination of Pessa et al and Hayakawa et al teaches cleansing the surface of a first crystal by thermal desorption ('518 col 4, ln 45-56), depositing a first layer of a first material of arsenic ('218 col 3, ln 39-50) over the surface of the first crystal of GaAs or Si ('218 Abstract), depositing a second material of Gallium ('218 col 3, ln 50-60) over the first layer and epitaxially growing a second crystal over the second layer ('218 col 3, ln 65 to col 4, ln 5), wherein the first layer substantially accommodates strain accumulated between the first crystal and the second crystal during epitaxial growth, thereby substantially preventing strain relaxation and formation of dislocation defects ('218 col 2, ln 35-42). The key differences between the instantly claimed invention and the prior art are appellants' misinterpretation of the rejection made by the Examiner and the Examiner's broad interpretation of the claimed invention.

The first key difference is the appellants attempt to limit the combination of Pessa et al and Hayakawa et al to only four layers; the substrate, a monolayer of Arsenic, a monolayer of Gallium and an epitaxially grown GaAs crystal. The combination of Pessa et al and Hayakawa et al teaches repeating the steps of depositing a monolayer of Arsenic and Gallium to form a superlattice buffer layer and forming an epitaxial GaAs crystal over the superlattice buffer. Appellants' incorrect interpretation of the references eliminates the subsequent layers used to

form the superlattice, which would render the combination of Pessa et al and Hayakawa et al inoperable, as suggested by appellants. However, the instantly claimed invention is not as limited as suggested by appellants to four layers and merely requires at least four layers.

The second key difference is the Examiner's interpretation of the "first layer substantially accommodates strain accumulated between the first crystal and the second crystal during epitaxial growth" limitation of claim 1. The Examiner's interpretation of this limitation is the first layer merely has to accommodate ***any*** amount, which can be very small, of the strain between the first crystal and the second crystal during epitaxial growth. The appellants' arguments on page 18 of the appeal brief suggest the strain is accommodated entirely by first layer and cannot be accommodated by other layers. The instantly claimed invention does not claim the amount or degree of strain accommodated by the first layer, merely that the first layer does accommodate strain, which is taught by the combination of Pessa et al and Hayakawa et al.

Issue 1:

Appellants' argument concerning Pessa on pages 16 and 17 of the appeal brief is noted. Appellants' allege the Examiner has failed to fully consider the complete teachings of Pessa and acknowledge the process of stacking Ga and As layers until a desired thickness is obtained. Appellants' are not limited to only four layers (first crystal, first layer, second layer and second crystal); therefore Pessa is not limited to only four layers. The Examiner has not suggested eliminating the essential steps of Pessa, which require stacking Ga and As layers until a desired superlattice thickness is obtained, as suggested by appellants. The Examiner maintains the first two layers of the superlattice buffer layer of Pessa reads on appellants first and second layer; and

the instantly claimed invention is open to depositing additional layers, which are used to form the remaining portion of the buffer layer taught by Pessa et al.

Appellants' argument concerning the limitation of the "first layer substantially accommodates strain accumulated between the first crystal and the second crystal during epitaxial growth, thereby substantially preventing strain relaxation" (page 18) is noted. The appellants' allege a one atom thick layer of a two atom thick buffer layer would not meet this limitation. The Examiner agrees with is allegation. However, Pessa is not limited to a two atom thick buffer layer; therefore the argument is not applicable. Also, the appellants admit the strain relief is distributed over all of the layers (page 18, lines 7-9), which would include the first layer of Pessa. Therefore, at least a portion of the strain is relieved by the first layer of Pessa, which meets this limitation because the amount or degree of strain accommodated is not claimed.

Appellants' argument that Pessa teaches away from preventing strain relaxation and the formation of dislocation defects; thereby preventing mismatch dislocations (page 19 and 39) is noted. Appellants allege that Pessa teaches a reduction in lattice strain by creating mismatch dislocations. The Examiner agrees with this statement, however Pessa goes on teach the creating mismatch dislocations lead to a **reduction** of disadvantageous threading dislocations penetrating deep into a GaAs layer and the confinement of defects within a narrow interface, note column 2, lines 35-42. Therefore, Pessa teaches creating dislocations to prevent further dislocations from being formed, which meets this limitation. It is also noted that appellants have not claimed the amount or degree dislocation defect prevention. Therefore, the prevention of at least one dislocation defect would meet this limitation, which is taught by Pessa et al.

Appellants' argument that Pessa teaches away from Hayakawa et al is noted. Appellants allege that Hayakawa teaches complete removal of an As layer, while Pessa teaches formation of an atom thick layer of As. Appellants have misinterpreted the combination of references. Hayakawa et al teaches a method of cleaning a substrate using a radiation treatment to remove an oxidized film (col 4, ln 45-55), which occurs prior to a deposition step. Hayakawa et al goes on to teach As deposition on the clean substrate (col 5, ln 1-2). Pessa does not teach away from a cleaning step to remove oxide from a substrate, as alleged by appellants. Nor does Hayakawa teach away from depositing an As layer after cleaning the substrate. In regard to Hayakawa teaching of using a low temperature in order to prevent deterioration of a GaAs substrate, Pessa et al does teach using a low growth temperature of 100-500°C (col 3, ln 33-35), which is in the range taught by Hayakawa et al.

Appellants' arguments regarding claims 2-3 (pages 22-23 and 37) are noted. Appellants allege that Hayakawa does not teach a vapor pressure ranges from about 0.004 Pa to about 0.012 Pa because Hayakawa's **preferred embodiment** uses lower pressures. The Examiner admits that Hayakawa's preferred embodiment uses lower pressures, however Hayakawa disclosure is not limited to preferred embodiments and Hayakawa teaches using vapor pressures in the range of 10^{-4}-10^{-5} torr (0.013 to 0.0013 Pa), which is within the claimed range. A reference may be relied upon for all that is would have reasonably suggested to one having ordinary skill in the art, including non-preferred embodiments (MPEP 2123).

Appellants' arguments regarding claim 5 (page 23-24) is noted. Appellants allege that Pessa and Hayakawa teach using GaAs and As_4 and do not teach a GaP or InP crystal with InAs, P_2 or P_4. Claim 5 recites, "the first crystal comprises GaAs, GaP, InAs, **or** InP, and wherein the

desorption vapor comprises As_2 **or** As_4 **if** the first crystal is GaAs **or** InAs, **or** the desorption vapor comprises InAs, P_2, **or** P_4 **if** the crystal is GaP or InP". Claim 5 recites the use of different crystals and desorption vapours in the alternative. The combination of Pessa and Hayakawa et al teaches GaAs and As_4, as admitted by appellants on page 23-24, which meets the limitations of claim 5.

Appellants' argument regarding claim 6 (pages 24 and 37) is noted. Appellants allege that the combination of Pessa and Hayakawa does not teach removing adjusting the thickness by varying a temperature of the crystal. The Examiner maintains Pessa teaching of removing excess arsenic through re-evaporation reads on this limitations. Appellants allege the time period used by Pessa to deposit the one atom thick layer is used to adjust the thickness of the layer, which is not the case. Pessa does teach allowing the As vapor to act on substrate for the formation of an one atom layer, as suggested by applicant. Pessa also teaches the time period is not critical since the excess arsenic is removed through re-evaporation (col 3, ln 40-50). Hayakawa et al teaches As is completely evaporated by a heating process (col 4, ln 60-61). Therefore, the combination of Pessa and Hayakawa teaches removing excess As through a re-evaporation, which can be accomplished by a heating process.

Issue 2:

In response to applicant's argument that Ogasawara is nonanalogous art (page 27), it has been held that a prior art reference must either be in the field of applicant's endeavor or, if not, then be reasonably pertinent to the particular problem with which the applicant was concerned, in order to be relied upon as a basis for rejection of the claimed invention. See *In re Oetiker*, 977

F.2d 1443, 24 USPQ2d 1443 (Fed. Cir. 1992). In this case, Ogasawara et al teaches the formation of GaAs, which is the same material being formed by Pessa, Hayakawa and appellants; therefore is analogous art.

In response to applicant's argument that there is no suggestion to combine the references, the examiner recognizes that obviousness can only be established by combining or modifying the teachings of the prior art to produce the claimed invention where there is some teaching, suggestion, or motivation to do so found either in the references themselves or in the knowledge generally available to one of ordinary skill in the art. See *In re Fine*, 837 F.2d 1071, 5 USPQ2d 1596 (Fed. Cir. 1988) and *In re Jones*, 958 F.2d 347, 21 USPQ2d 1941 (Fed. Cir. 1992). In this case, Ogasawara teaches irradiating an As beam on a substrate to prevent out-diffusion of As from a GaAs layer when heated. Therefore, it would have been obvious to a person of ordinary skill in the art at the time of the invention to modify the combination of Pessa et al and Hayakawa et al step of heating to a second growth temperature ranging by irradiating with an As beam during the heating step to prevent out-diffusion of As from the GaAs layer, as taught by Ogasawara.

Appellants' argument that Ogasawara does not teach the pressure of As or to keep the pressure of the first vapor at 0.008 Pa is noted. Ogasawara teaches **while still** irradiating an As beam on a substrate to prevents out-diffusion (col 2, ln 59-68), which is a teaching that the pressure used during deposition of As is used during the prevention of out-diffusion. Ogasawara is silent to the pressure used. However, the pressure of As for deposition is taught by Hayakawa et al to be 10^{-4}-10^{-5} torr (0.013 to 0.0013 Pa), which encompasses the pressure of 0.008 Pa claimed by appellants.

In response to applicant's argument that the examiner's conclusion of obviousness is based upon improper hindsight reasoning (page 29), it must be recognized that any judgment on obviousness is in a sense necessarily a reconstruction based upon hindsight reasoning. But so long as it takes into account only knowledge which was within the level of ordinary skill at the time the claimed invention was made, and does not include knowledge gleaned only from the applicant's disclosure, such a reconstruction is proper. See *In re McLaughlin*, 443 F.2d 1392, 170 USPQ 209 (CCPA 1971). The motivation comes directly from the teachings of Ogasawara, namely using As vapor to prevent out-diffusion of As from a GaAs layer during heating.

In response to appellants' arguments against the references individually (page 29), one cannot show nonobviousness by attacking references individually where the rejections are based on combinations of references. See *In re Keller*, 642 F.2d 413, 208 USPQ 871 (CCPA 1981); *In re Merck & Co.*, 800 F.2d 1091, 231 USPQ 375 (Fed. Cir. 1986). Ogasawara is not relied upon as a teaching of forming a Ga monolayer. Ogasawara is relied upon solely as a teaching of raising the temperature of a GaAs layer while irradiating with an As beam to prevent out-diffusion during the heating step.

In response to applicant's arguments against the references individually (page 30), one cannot show nonobviousness by attacking references individually where the rejections are based on combinations of references. See *In re Keller*, 642 F.2d 413, 208 USPQ 871 (CCPA 1981); *In re Merck & Co.*, 800 F.2d 1091, 231 USPQ 375 (Fed. Cir. 1986). Ogasawara is not relied upon as a teaching of the first crystal. Ogasawara is relied upon solely as a teaching of raising the temperature of a GaAs layer while irradiating with an As beam to prevent out-diffusion during the heating step, which is applicable regardless of the substrate.

Issue 3:

Appellants' argument that combining the two atom thick buffer layer of Pessa with Grunthaner's thick buffer layer is noted (page 32). As addressed previously, Pessa is not limited to a two atom thick buffer layer and therefore is compatible with the teaching of Grunthaner.

In response to applicant's argument that Grunthaner is nonanalogous art (page 33), it has been held that a prior art reference must either be in the field of applicant's endeavor or, if not, then be reasonably pertinent to the particular problem with which the applicant was concerned, in order to be relied upon as a basis for rejection of the claimed invention. See *In re Oetiker*, 977 F.2d 1443, 24 USPQ2d 1443 (Fed. Cir. 1992). In this case, Grunthaner et al teaches a method of forming InAs on a GaAs buffer layer, which is in the same field of appellants' endeavor, namely forming an InAs layer, note instant claim 24.

In response to applicant's argument that there is no suggestion to combine the references (page 33), the examiner recognizes that obviousness can only be established by combining or modifying the teachings of the prior art to produce the claimed invention where there is some teaching, suggestion, or motivation to do so found either in the references themselves or in the knowledge generally available to one of ordinary skill in the art. See *In re Fine*, 837 F.2d 1071, 5 USPQ2d 1596 (Fed. Cir. 1988) and *In re Jones*, 958 F.2d 347, 21 USPQ2d 1941 (Fed. Cir. 1992). In this case, Grunthaner et al teaches the flux ratios of In to As are critical to control the defect generation in the lattice mismatched epitaxy of InAs on GaAs (col 2, ln 30-35), which is a teaching that flux ratios are result effective variables. Therefore, it would have been obvious to a person of ordinary skill in the art at the time of the invention to modify the combination of Pessa et al, Hayakawa et al and Ogasawara by optimizing the flux ratio to obtain the claimed flux ratio

by conducting routine experimentation of a result effective variable to control defect generation, based on the teachings of Grunthaner et al. Furthermore, the selection of reaction parameters such as temperature and concentration is obvious (In re Aller 105 USPQ 233, 255 (CCPA 1955)).

Appellants' argument that Grunthaner approach to determining the flux ratio would not have yield the range of 1.5 to about 3 through routine experimentation is noted (page 33-34). This argument is viewed as mere attorney argument, which lacks evidenced; therefore is not found persuasive. Grunthaner et al teaches the flux ratio is critical, which is a teaching that flux ratios are result effective variables. Grunthaner et al does not explicitly teach the flux ratio, however the Examiner maintains a person of ordinary skill in the art at the time of the invention would have been able to determine the optimum ratio without undue experimentation.

Issue 4:

In response to applicant's argument that Kubiak is nonanalogous art (page 36), it has been held that a prior art reference must either be in the field of applicant's endeavor or, if not, then be reasonably pertinent to the particular problem with which the applicant was concerned, in order to be relied upon as a basis for rejection of the claimed invention. See *In re Oetiker*, 977 F.2d 1443, 24 USPQ2d 1443 (Fed. Cir. 1992). In this case, Kubiak et al teaches a method of growing III-V semiconductors by vaporizing Indium (In) in a molecular beam deposition process (col 3, ln 65-68 and Abstract), which is in the same field of endeavor, as appellants, namely introducing a flux In vapor to form a III-V semiconductor of InAs, note instant claim 32.

In response to applicant's argument that there is no suggestion to combine the references (page 36), the examiner recognizes that obviousness can only be established by combining or

modifying the teachings of the prior art to produce the claimed invention where there is some teaching, suggestion, or motivation to do so found either in the references themselves or in the knowledge generally available to one of ordinary skill in the art. See *In re Fine*, 837 F.2d 1071, 5 USPQ2d 1596 (Fed. Cir. 1988) and *In re Jones*, 958 F.2d 347, 21 USPQ2d 1941 (Fed. Cir. 1992). In this case, Kubiak et al teaches the temperature of an effusion cell for In is 800-840°C and beam intensity may be regulated by varying the cell temperature. Therefore, it would have been obvious to a person of ordinary skill in the art at the time of the invention to modify the combination of Pessa et al, Hayakawa et al, Ogasawara and Grunthaner by optimizing the temperature of In vapor by conducting routine experimentation based Kubiak's teaching that the temperature of In affects beam intensity and is conventionally between 800-840°C. Furthermore, the selection of reaction parameters such as temperature and concentration is obvious. Furthermore, the selection of reaction parameters such as temperature and concentration is obvious (In re Aller, 220 F.2d 454, 456, 105 USPQ 233, 235(CCPA 1955)).

In response to applicant's argument that the examiner's conclusion of obviousness is based upon improper hindsight reasoning (page 36), it must be recognized that any judgment on obviousness is in a sense necessarily a reconstruction based upon hindsight reasoning. But so long as it takes into account only knowledge which was within the level of ordinary skill at the time the claimed invention was made, and does not include knowledge gleaned only from the applicant's disclosure, such a reconstruction is proper. See *In re McLaughlin*, 443 F.2d 1392, 170 USPQ 209 (CCPA 1971). The selection of reaction parameters such as temperature and concentration is obvious (In re Aller, 220 F.2d 454, 456, 105 USPQ 233, 235(CCPA 1955));

therefore hindsight is not employed to optimize the temperature, as suggested by appellants because selection of temperature is within the skill of a person of ordinary skill in the art.

Appellants' argument that the combination of Pessa, Hayakawa, Ogasawara and Grunthaner does not teach a pressure of 0.008 Pa is noted (pages 37 and 38). The same response applied to claims 2 and 3 above, applies; therefore this argument is not found persuasive.

Appellants' argument that the combination of Pessa, Hayakawa, Ogasawara and Grunthaner does not teach adjusting the thickness by heating is noted. The same response applied to claim 6 above applies; therefore this argument is not found persuasive.

Appellants' argument that the combination of Pessa, Hayakawa, Ogasawara and Grunthaner does not teach prevention of dislocation defect formation is noted. The same response applied addressing the argument of page 19 of the appeal brief above applies; therefore this argument is not found persuasive.

Appellants' argument that the combination of Pessa, Hayakawa, Ogasawara, Grunthaner and Kubiak does not teach the ratio of flux is maintained at 2.5 is noted. The same response applied to issue 3 of the appeal brief above applies; therefore this argument is not found persuasive.

For the above reasons, it is believed that the rejections should be sustained.

Respectfully submitted,

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MJS
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